PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G01F 17/00, 23/22 — A1

(11) International Publication Number: WO 98/01726

(43) International Publication Date: 15 January 1998 (15.01.98)

(21) International Application Number: PCT/GB97/01821

(22) International Filing Date: 4 July 1997 (04.07.97)

(30) Priority Data:
9614323.5 8 July 1996 (08.07.96) GB

(71)(72) Applicant and Inventor: WILLIS, William, Gordon [GB/GB]; Chase Cottage, The Green, Godstone, Surrey RH9 8DZ (GB).

(74) Agents: FRY, Alan, Valentine et al.; Fry Heath & Spence, The Old College, 53 High Street, Horley, Surrey RH6 7BN (GB).

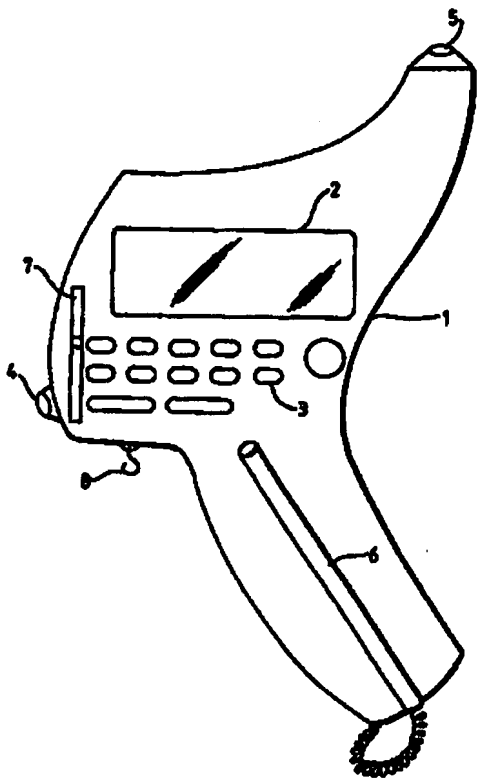
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: APPARATUS FOR AND A METHOD OF MEASURING THE FLUID CONTENTS OF CONTAINERS

(57) Abstract

A hand-held device for measuring the amount of fluid present in a partially filled container includes a temperature sensitive means for determining the level of fluid present in the container and distance sensitive means for determining the height of this level above a predetermined datum level. A microprocessor is programmed with an algorithm into which the determined values can be entered together with values representative of the internal configuration and volume of the container, the device including a display for displaying the measured amount of fluid present in the container.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

APPARATUS FOR AND A METHOD OF MEASURING THE FLUID CONTENTS OF CONTAINERS

This invention relates to apparatus for and methods of measuring the contents of containers, more especially the amount of fluid present in a partially filled container and, possibly, the dry stock contents of such a container. The term "fluid" as used herein embraces liquids and flowable material in solid form.

There are numerous occasions when it is necessary accurately to measure the liquid contents of a bottle, barrel, keg or similar container. One such occasion arises when conducting audits of licensed premises and in particular when valuing the stock held on such premises. Such valuations must sensibly include the contents of partially filled bottles of spirits and other liquids, and the contents of barrels and kegs of beer and the like. Presently, the amount of spirits and beers contained within partially filled bottles, barrels and kegs is simply estimated. For companies owning several licensed premises, misapproximations of the quantity of spirits contained in opened bottles and barrels can result in significant inaccuracies in the resulting stock valuation.

The present invention sets out in one aspect to provide apparatus for and methods of providing an accurate measure of the amount of fluid present in a container.

An auditor must also take into account unused stock which may be held in cartons or packaging as received from suppliers. Such cartons or packaging are generally bar coded and a further aspect of the present invention is to provide hand-held apparatus by use of which a complete audit can be undertaken.

According to the present invention in one aspect there is provided hand-held apparatus including an electronically operated microprocessor having a visual display linked to a memory in which is stored data representative of the dimensions and configuration of a plurality of containers within which fluid is stored and from which the volume of fluid present in any such container can be calculated from a knowledge its level and attitude of the container, the apparatus further comprising means for determining the level of fluid within a container and the height of this level above a predetermined datum position, means for entering into memory signals representative of the determined value and the dimensions and configuration of the container being measured, and means for automatically computing from these signals the amount of fluid present in the container and displaying this computed amount on the visual display.

In another aspect the invention provides a method of measuring the amount of fluid present in a partially filled container, the method comprising the steps of determining the level of the fluid content of the container with the container in a given attitude and the height of this level above a predetermined datum level, entering this determined value into a memory of a microprocessor in which is stored data representative of the dimensions and configuration of a plurality of containers, and means for calculating therefrom the fluid content of the container.

In a further aspect, the invention provides apparatus for sensing a value or values representative of the volume or weight of the contents of a container, selecting from a data store data representative of the

configuration and dimensions of the container, and determining from the sensed values and the data extracted from store the volume and/or weight of the contents of the container.

Data representative of the monetary values per unit volume of a plurality of fluids may also be retained in the memory of the microprocessor thereby enabling a visual display to be provided for the value of the measured fluid content of the container.

The level determining means may comprise an infra-red temperature measuring device capable of detecting a change in temperature occurring between the fluid and gas content of an opaque container. The height determining means may comprise an infra-red device operable to measuring distance.

The fluid may be a liquid or a flowable medium such as a powder or granulated material.

In a still further aspect the invention provides a hand-held device for measuring the amount of fluid present in a partially filled container, the device including temperature sensitive means for determining the level of fluid present in the container and distance sensitive means for determining the height of this level above a predetermined datum level, and a microprocessor programmed with an algorithm into which the determined values can be entered together with values representative of the internal configuration and volume of the container, the device including a display for displaying the measured amount of fluid present in the container.

The device may also include a bar code reader connected to send signals to the microprocessor.

The device may be capable of being connected to transmit data held

in memory to a microprocessor programmed to provide accounting date.

The invention will now be described by way of example only with reference to the accompanying diagrammatic drawing in which the sole Figure is a perspective view of a measuring device in accordance with the invention.

The device illustrated in the drawings comprises a hand-held device 1 in which is housed a battery operated electronic microprocessor including a visual display 2 and a series of key pads 3 by which data can be entered manually into the memory of the microprocessor device. The device further includes an infra-red meter 4 for measuring distance from a selected datum level, a temperature sensitive infra-red meter 5 and an electronic bar code reader 6. The device also includes a spirit level 7.

The meters 4 and 5 are connected to transmit data representative of measured distances and temperatures to the microprocessor. Retained in memory within the microprocessor is a look-up table of data representative of the internal dimensions and configuration of a plurality of containers likely to be encountered by a user of the device. Each such container can be identified by the user entering a code unique to the container under measurement via the key pads 3 or by using a bar code reader if the information required is bar coded on the container. On entry of the measured values and the appropriate code for the container being measured, the microprocessor operates automatically to provide a visual display of the fluid contents of the container. A look-up table of data representative of the monetary value of unit volume of fluids likely to be encountered by a user of the device may also be retained in memory to enable the monetary value of the measured contents of a container to be displayed.

The device includes an extendable hook 8 connected to an electronic balance housed within the device and operable to provide a measure of the

weight of opened cartons of, for example, packets of crisps and peanuts. A look-up table may be retained within the memory of the microprocessor of the weight of a plurality of cartons likely to be encountered by a user of the device when unopened from which the number of packets or like present within the carton can be calculated. Again, a monetary value of such items can be displayed.

All of the information is capable of being down-loaded to a printer or computer terminal in the normal way.

In use, the device is used by a person conducting a stock audit of unused and partially used consumables such as bottled spirits of, for example, a licensed premises. For unopened stock bearing a bar-code, the bar-code reader is employed to record the number and value for those stock items in memory within the microprocessor. For unopened stock bearing no bar-code, the number and value of the items in question are entered via the key pads.

For partially filled containers such as bottles, barrels, kegs and the like, each liquid level (if not visible) is determined by moving the infra-red temperature meter 5 along the side of the container until a charge in recorded temperature is detected. This temperature change occurs as the meter is moved from a position in which it measures liquid temperature to a position in which it measures gas temperature or vice versa. With the meter 5 held alongside the detected liquid level, the infra-red meter 4 is operated to measure the distance between this level and the base of the container. This measured information is then transmitted to the microprocessor and the code relevant to the shape and configuration of the container is entered via the key pad or bar code reader to enable the volume of liquid present in the container to be calculated and either displayed or retained or stored in memory for later retrieval. The value of this liquid volume may also be displayed or retained or stored in memory.

Partially filled containers can be suspended from the hook 8 and weighed,this weight being compared with the stored data of the respective look-up table to provide a display of the number of items left in the carton and, if required, their value. Alternatively, the information may be retained or stored in memory. Information from tills may also be down loaded into memory or store and used in later calculations when providing a stock report.

Once an audit has been completed, all of the information gleaned from the audit can be down-loaded via a printer or via a terminal into a remote microprocessor or computer for analysis purposes.

The invention enables the entire audit to be completed using a single hand-held device.

It will be appreciated that the foregoing is merely exemplary of measuring devices in accordance with the invention and that modifications can readily be made thereto without departing from the scope of the invention as set out in the appended claims. Thus, a hygrometer probe may be provided to enable, for example, alcohol contents of spirits and the like to be measured.

CLAIMS

1. Hand-held apparatus including an electronically operated microprocessor having a visual display linked to a memory in which is stored data representative of the dimensions and configuration of a plurality of containers within which fluid is stored and from which the volume of fluid present in any such container can be calculated from a knowledge of the fluid level and attitude of the container, the apparatus further comprising means for determining the level of fluid within a container and the height of this level above a predetermined datum position, means for entering into memory signals representative of the determined value and the dimensions and configuration of the container being measured, and means for automatically computing from these signals the amount of fluid present in the container and displaying this computed amount on the visual display.

2. Apparatus as claimed in Claim 1 wherein the level determining means comprises an infra-red temperature measuring device capable of detecting a change in temperature occurring between the fluid and gas content of the container.

3. Apparatus as claimed in Claim 1 or Claim 2 wherein the height determining means comprises an infra-red device, operable to measure distance.

4. Apparatus as claimed in any one of Claims 1 to 3 further comprising a keyboard for manually entering data into memory.

5. Apparatus as claimed in any one of Claims 1 to 4 further comprising an electronic bar-code reader for entering data into memory.

6. Apparatus as claimed in any one of Claims 1 to 4 further comprising

a spirit level.

7. Apparatus as claimed in any one of the preceding Claims wherein the stored data is in the form of one or more look-up tables of data representative of the internal dimensions and configurations of a plurality of containers, each such container being identifiable by a unique code.

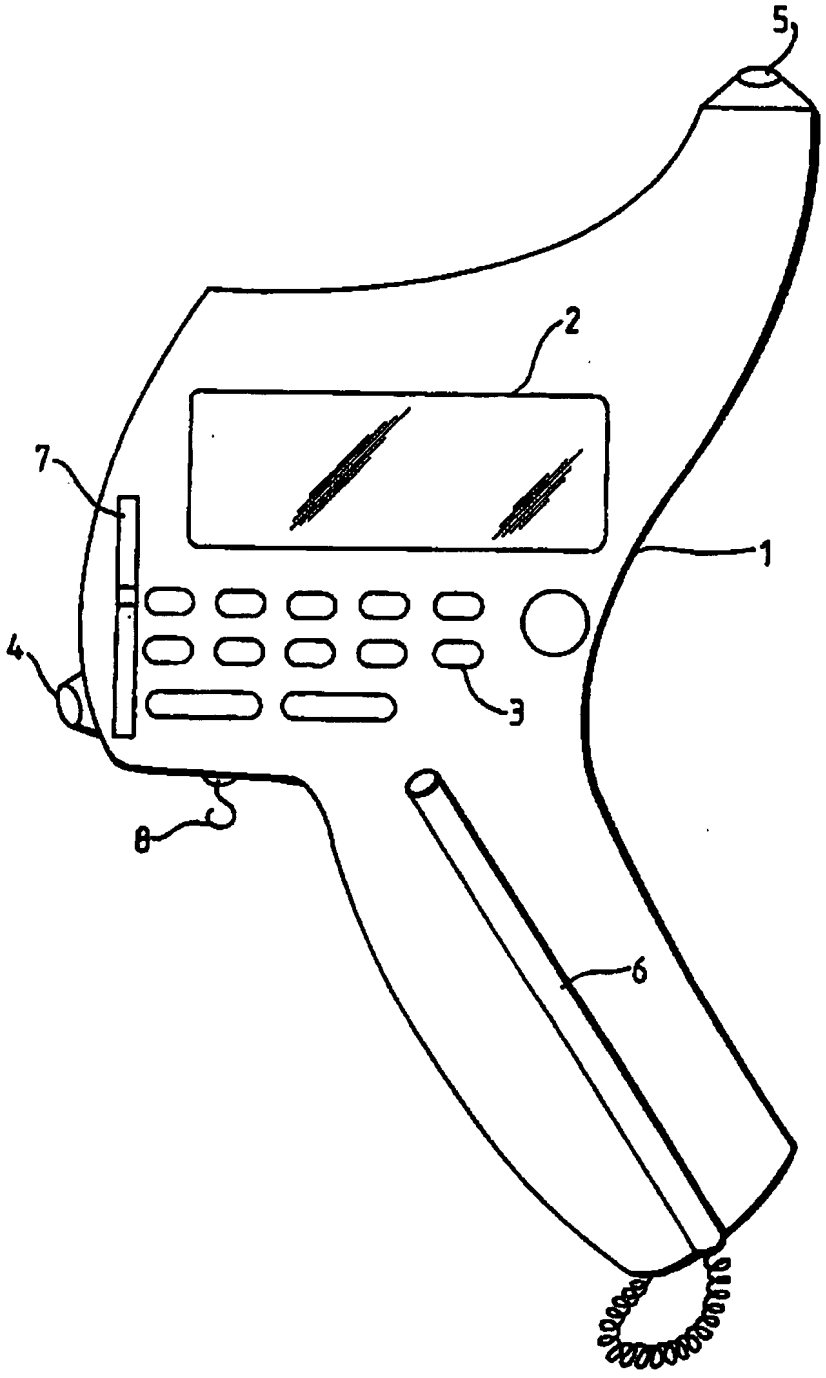
8. Apparatus as claimed in any one of the preceding Claims further comprising an electronic balance operable to provide a measure of weight of a container and its contents supported on or suspended from the apparatus.

9. A method of measuring the amount of fluid present in a partially filled container, the method comprising the steps of determining the level of the fluid content of the container with the container in a given attitude and the height of this level above a predetermined datum level, entering this determined value into a memory of a microprocessor in which is stored data representative of the dimensions and configuration of a plurality of containers, and means for calculating therefrom the fluid content of the container.

10. Apparatus for sensing a value or values representative of the volume or weight of the contents of a container, selecting from a data store data representative of the configuration and dimensions of the container, and determining from the sensed values and the data extracted from store the volume and/or weight of the contents of the container.

11. A hand-held device for measuring the amount of liquid present in a partially filled container, the device including temperature sensitive means for determining the level of liquid present in the container and

distance sensitive means for determining the height of this level above a predetermined datum level, and a microprocessor programmed with an algorithm into which the determined values can be entered together with values representative of the internal configuration and volume of the container, the device including a display for displaying the measured amount of liquid present in the container.


5
2
7
1
4
3
8
6

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 97/01821

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G01F17/00 G01F23/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 211 678 A (STEPHENSON STANLEY V ET AL) 18 May 1993 see abstract see column 4 - column 6 see column 7, line 38 - column 8, line 32; figures 1,2	9,10
A	---	1,11
A	EP 0 049 542 A (PHILIPS ELECTRONIC ASSOCIATED ;PHILIPS NV (NL)) 14 April 1982 see abstract; claim 1; figure 1	1,9-11
A	---	1,9-11
	DE 34 13 816 A (LEIFELD & LEMKE MASCHF) 17 October 1985 see abstract; figures 1-3	

	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
29 September 1997	07. 10. 97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Vorropoulos, G

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Intern ional Application No
PCT/GB 97/01821

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 929 829 A (DEDDEN HUBERT ET AL) 29 May 1990 see abstract see column 3 - column 4; figure 1	1,3,9-11

1

INTERNATIONAL SEARCH REPORT

.formation on patent family members

Inter ional Application No
PCT/GB 97/01821

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5211678 A	18-05-93	US 5319964 A	14-06-94
		US 5272920 A	28-12-93
EP 0049542 A	14-04-82	GB 2084717 A	15-04-82
		CA 1165590 A	17-04-84
		US 4442357 A	10-04-84
DE 3413816 A	17-10-85	NONE	
US 4929829 A	29-05-90	DE 3828821 A	01-03-90
		EP 0355643 A	28-02-90
		JP 1951569 C	28-07-95
		JP 2102438 A	16-04-90
		JP 6078928 B	05-10-94